**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

BEFORE THE HONORABLE BOARD OF PATENT APPEALS

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| Application No. | : | 10/780,686 | Confirmation No. 1093 |
| Applicant | : | Maged E. Beshai | |
| Filed | : | February 19, 2004 | |
| Title | : | POLYPHASE CIRCULATING SWITCH | |
| TC/Art Unit | : | 2416 | |
| Examiner | : | Nguyen Hoang Ngo | |
| Attorney Docket No. | : | 92644-33 | |
| Customer No. | : | 22463 | |

**Mail Stop Appeal Brief - Patents**
Commissioner for Patents
P. O. Box 1450
Alexandria, VA 22313-1450
U.S.A.

Dear Sir:

## APPELLANT'S BRIEF

The following is the Appellant's Brief, submitted under the provisions of 37 C.F.R. 41.37. The fee of $540 required by 37 C.F.R. 41.20(b) is enclosed.

***Table of Contents***

**Real Party in Interest**

The real party in interest is Nortel Networks Limited, the assignee of record.

**Related Appeals and Interferences**

There are no related appeals or interferences.

## **Status of Claims**

Claims 17-25 are pending in this application and stand rejected. Claims 1-16 have been cancelled; claims 26-39 have been withdrawn. Claims 17-25 are being appealed.

**Status of Amendments**

No amendment has been filed subsequent to the final rejection.

**Summary of Claimed Subject Matter**

**Claim 17**

A polyphase circulating switch (FIG. 36, 3600; FIG. 50, 5000) has a plurality of switch modules (3622; 5022). The switch also has a rotator array (3650; 5025) with a plurality of clockwise rotators (5020A, 5020C) and a plurality of counterclockwise rotators (5020B, 5020D). A rotator is a "passive device …which cyclically establishes one-to-one connections between a plurality of inlets and a plurality of outlets" (page 15, lines 11-14; paragraph 108 in the application as published). A counterclockwise rotator has a direction of rotation (i.e., a direction of stepping through a rotation cycle) opposite to the direction of rotation of a clockwise rotator (page 15, lines 15-20 and page 24, line 17-27; paragraphs 109, 110 and 161).

Each of the switch modules is communicatively connected through a dual channel 5026 to each clockwise rotator and each counterclockwise rotator (page 73, lines 18-31; paragraph 352).

Each of the clockwise rotators and each of the counterclockwise rotators has a respective reference phase. The reference phase of a rotator is "defined by the output port to which input port 0 is connected at the start of a rotation cycle" (page 75, line 26 to page 76, line 2; paragraph 360). A rotation cycle is a "period of time during which a rotator completes a predetermined inlet-outlet connectivity pattern". "A rotation cycle includes an integer number of rotation phases" (page 17, lines 6-8; paragraph 124). A rotation phase is a period of time during which a rotator maintains a particular inlet-outlet connectivity (page 17, lines 4-5; paragraph 123).

At least two of the clockwise rotators have different reference phases and at least two of the counterclockwise rotators have different reference phases (page 75, line 13 to page 76, line 10; paragraphs 358-362).

The described switch provides an advantage where direct connections may be made through the switch from any switch module to any other switch module. A direct connection is one from a source switch module to a destination switch module. An indirect connection is one from the source switch module to an intermediate module and then from the intermediate module to the destination

switch module (page 30, lines 4-21; paragraph 191).

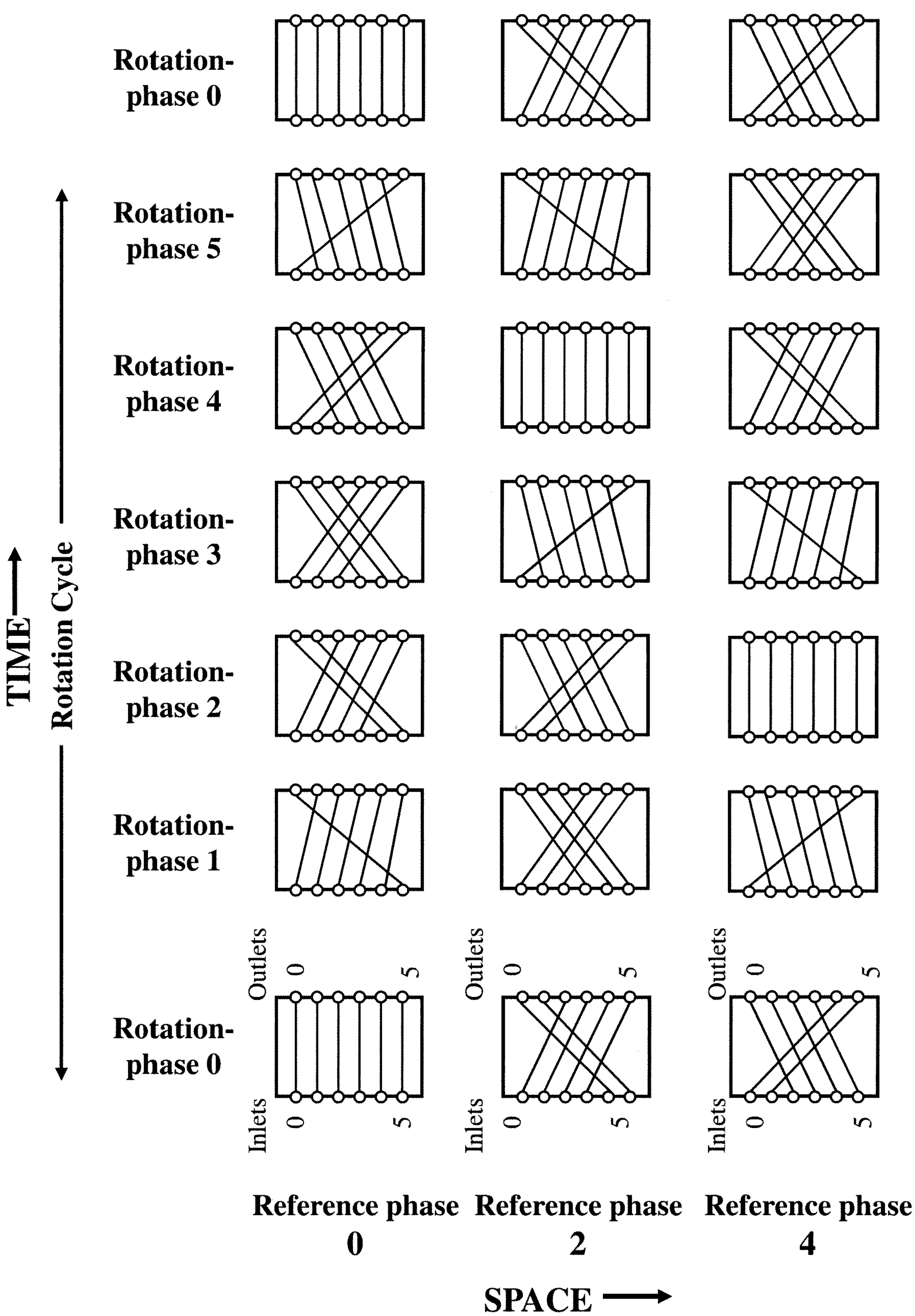
As recited at page 74, lines 22-29 (paragraph 356) (emphasis added), "If all clockwise rotators have the same clockwise reference phase and all the counterclockwise rotators have the same counterclockwise reference phase, the switching delay (transit delay) of an indirect connection traversing any clockwise rotator and any counterclockwise rotator would be constant and dependent only on the source and sink switch modules. With such organization of the rotator array, the switching delay of an indirect connection for a directed switch module pair may be as small as one time slot (one phase duration) and an indirect connection of another directed switch module pair may be as high as one rotation cycle (N time slots)."

With at least two of the clockwise rotators having different reference phases and at least two of the counterclockwise rotators having different reference phases, the rotation phases of the rotators may be spread to spread systematic switching delay patterns for each indirect connection so that a connection can be established along the indirect path of least switching delay (page 76, lines 11-12 and page 82, line 13 to page 83, line 7; paragraph 363, 386, and FIG. 67).

The action of the polyphase circulating switch is illustrated in FIG. 51A to FIG. 51D and FIG. 52A to FIG. 52D and described in the paragraphs at page 75, line 13 to page 76, line 23 (paragraphs 358 to 364). The action of the described polyphase circulating switch is illustrated in the drawing below entitled "Polyphase Circulating Switch" which illustrates the operation of three clockwise rotators (Space axis) through one rotation cycle (Time axis). Each of the three rotators has six inlets, six outlets, and a rotation cycle of six rotation phases. The inlets of a rotator are individually identified by indices 0 to 5, the outlets are individually identified by indices 0 to 5, and the rotation phases are individually identified by indices 0 to 5. The three rotators have different reference phases. As described at page 75 line 26 to page 76 line 2 (paragraph 360), the reference phase of a rotator is defined by the output port to which input port 0 is connected at the start of a rotation cycle. As indicated in the drawing below, a first rotator has a reference phase 0, a second rotator has a reference phase of 2, and a third rotator has a reference phase of 4. During any rotation phase, the three rotators have different inlet-outlet connectivity patterns. Thus, a connection from a switch

module to another switch module may be routed through the one of the three rotators that results in the least switching delay.

## Polyphase Circulating Switch



**Claim 18** defines a rotation cycle (1310, FIG. 13, page 32, line 27 to page 33, line 11; paragraph 200), and describes the cyclic connectivity of the polyphase circulating switch of claim 17. Each clockwise rotator (5020A, 5020C, FIG. 50) connects each switch module (each of 5022(0) to 5022(7), FIG. 50) to each other switch module (5022(0) to 5022(7)) during a rotation cycle (1310), where the rotation cycle includes a plurality of rotation phases (1312, indices 0 to 15, page 32, line 27 to page 33, line 11; paragraph 200), and each of the counterclockwise rotators (5020B, 5020D, FIG. 50) connects each switch module (5022) to each other switch module (5022) during the rotation cycle (1310).

**Claim 19** describes a control system for the polyphase circulating switch of claim 17. The control system comprises a plurality of module controllers (3824 with indices 0 to 3, FIG. 38, page 55, line 27 to page 56, line 8; paragraph 289) and a master controller (3840, FIG. 38). Each switch module (3822(0) to 3822(3)) has a module controller (3824) and the master controller (3840) determines a schedule (page 64, lines 5-12; paragraph 321) for connections among the switch modules and communicates the schedule to the individual module controllers (3824(0) to 3824(3)).

**Claim 20** describes a feature of the polyphase circulating switch of claim 17 where the master controller (3840, FIG. 38) has the freedom to select any clockwise rotator (5020A, 5020C, FIG. 50) and any counterclockwise rotator (5020B, 5020D) for routing a connection. Thus, a connection may start with a clockwise rotator or a counterclockwise rotator. The freedom to start a connection at a clockwise rotator or a counterclockwise rotator is a major distinguishing feature of the claimed polyphase circulating switch.

**Claim 21** describes a feature of the switch of claim 17 where the master controller (3840, FIG. 38) determines a switching delay (5460, FIG. 54, page 77, lines 3-20; paragraphs 366, 367) from each of switch module (5022-0 to 5022-7, FIG. 50) to each other switch module (5022-0 to 5022-7) through each clockwise rotator (5020A, 5020C, FIG. 50) and through each counterclockwise rotator (5020B, 5020D).

**Claim 22** describes a feature of the polyphase circulating switch of claim 17 where a clockwise rotator (5020A, 5020C) is programmable (abstract, page 94, line 28 to page 95, line 12; paragraphs 439, 441) to set its reference phase instead of having a fixed reference phase.

**Claim 23** describes a feature of the polyphase circulating switch of claim 22 where the reference phases of the clockwise rotators (5020A, 5020C, FIG. 50) are evenly spread (page 105, lines 9-14; paragraph 471, FIG. 76) over the rotation cycle (1310, FIG. 13). Notably, the spread of the reference phases permits selecting a path of low delay (page 82, line 13 to page 83, line 7; paragraph 386, FIG. 67).

**Claim 24** describes a feature of the polyphase circulating switch of claim 17 where a counterclockwise rotator (5020B, 5020D) is programmable (abstract, page 94, line 28 to page 95, line 12; paragraphs 439, 441) to set its reference phase instead of having a fixed reference phase.

**Claim 25** describes a feature of the polyphase circulating switch of claim 24 where the reference phases of the counterclockwise rotators (5020B, 5020D) are evenly spread (page 105, lines 9-14; paragraph 471, FIG. 76) over the rotation cycle 1310, FIG. 13).

**Grounds of Rejection to be Reviewed on Appeal**

Whether claims 17 to 25 are unpatentable under 35 U.S.C. 103(a) over US6,876,649 to Beshai in view of US2003/0081548 to Langevin.

## Argument

### Claim 17

At the paragraph bridging pages 3 and 4 of the final action, the Examiner admits that Beshai fails to disclose the claim 17 feature of "at least two of said clockwise rotators having different reference phases and at least two of said counterclockwise rotators having different reference phases", however, the Examiner suggests that Langevin shows this feature. The Examiner specifically relies on paragraphs 48 and 233 of Langevin in this regard.

Applicant traverses this suggestion for the following reasons.

**At paragraph 48**, Langevin states: "Referring to FIG. 2 there is illustrated the sequence of four phases composing the rotation scheme of the known rotator switch illustrated in FIG. 1; these phases are referred as phase 0, 40; phase 1, 42; phase 2, 44; and phase 3, 46. At each phase of the rotation, a tandem node is connected with exactly one source node and with exactly one destination node, all tandem nodes being connected with different source nodes, and with different destination nodes."

Applicant submits that paragraph 48 merely describes a rotation cycle of <u>one</u> rotator. A rotator is characterized by (1) one reference phase and (2) a rotation cycle having multiple rotation phases. A rotation cycle (1310) is illustrated in FIG. 13 of the present application; a rotation cycle 1310 comprises a number of rotation phases 1312 (phases 0, 1, 2, and 3 in Langevin). A reference phase of a rotator having input ports indexed as 0, 1, 2, …, and output ports indexed as 0, 1, 2, …, is defined by the output port to which input port 0 is connected at the start of a rotation cycle (paragraph 360 of U.S. Publication 2004/0184448 the present application). Please see the above drawing entitled "Polyphase Circulating Switch".

Claim 17 recites a plurality (more than one) of clockwise rotators each having a respective reference phase and at least two clockwise rotators having different reference phases. A reference phase pertains to one, and only one, rotator. Claim 17 also recites a plurality of counterclockwise rotators each having a respective reference phase and at least two counterclockwise rotators having different reference phases.

Context is required to understand paragraph 233. This paragraph is under the heading in paragraph 209: "F. DBS Algorithm Extension for Rotator Architecture with Double-Bank Tandem Nodes". An extension of the known rotator switch of FIG. 1 which uses double-bank tandem nodes is illustrated in FIG. 12 (paragraph 36 in Langevin).

Paragraph 233 describes a scheduler, which is the sole objective of the Langevin reference. Paragraph 0001 in Langevin recites (*emphasis added*): "The present invention relates to scheduling algorithms, .... The present invention is particularly concerned with scheduling algorithms for rotator switch architectures, yet can be used as well for demand-driven space switch architectures." Paragraph 60 in Langevin recites: "Core Scheduler 52: the core scheduler 52 is the module implementing the process of deciding which source nodes have provided the IUs arriving at each destination node from its connected tandem node at each phase of the rotator."

Applicant notes that it is well known in the art that a scheduler is a computer program implemented in a computing device.

In contrast, claim 17 describes the architecture of a polyphase circulating switch.

Paragraph 233 describes a Destination-Based Scheduler 52 illustrated in FIG. 4 in Langevin. The Destination-Based Scheduler 52 is introduced in paragraph 38, and described throughout the Langevin reference as a module implementing a Destination-Based Scheduling Algorithm.

Specifically, paragraph 233 describes an algorithm labeled "DBS_5" which is first introduced in paragraph 218. As described in Langevin, DBS_5 is applicable to the switch structure of FIG. 12 which is derived from the known rotator switch of FIG. 1 in Langevin (FIG. 2 of the known rotator switch, U.S. Patent 5,168,492) and comprises <u>one</u> clockwise rotator and <u>one</u> counterclockwise rotator. Please see paragraphs 36 and 225 in Langevin (emphasis added):

"[0036] FIG. 12 illustrates an extension of <u>the known rotator switch of FIG. 1</u> using <u>double-bank tandem nodes</u>."

"[0225] When the DBS_5 function is used as the core scheduler for <u>the double-bank tandem node rotator switch architecture</u>, the destination node bias as seen by a source node disappears, since a source node has the same probability to be selected by any destination nodes, providing a random ordering of destination nodes is used for the source-selections."

Thus, paragraph 233 cited by the Examiner relates to a rotator switch having <u>one</u> clockwise rotator and <u>one</u> counterclockwise rotator. Claim 17 requires a first plurality of clockwise rotators each having a respective reference phase, a second plurality of counterclockwise rotators each having a respective reference phase, at least two of clockwise rotators having different reference phases, and at least two counterclockwise rotators having different reference phases. Clearly, the Langevin reference fails to meet this requirement.

At paragraph 215, Langevin states that "the proposed scheduler can be extended for … parallel rotator slices". At paragraphs 201 and 202 Langevin explains "using parallel rotator slices of degree v… At each scheduling phase … v tandem nodes terminate a scheduling rotation with respect to the same destination node y, and with respect to the same source node x. It is thus possible to perform source-selections for this destination node y on these v tandem nodes."

Langevin employs a technique known in the art as "slicing". Langevin slices the clockwise rotator 18, FIG. 1, into rotator slices as illustrated in FIG. 10 and FIG. 11. Likewise, counterclockwise rotator 28 is sliced into counterclockwise rotator slices as illustrated in FIG. 10 and FIG. 11. Although Langevin did not use either of the terms "clockwise rotator" or

"counterclockwise rotator", Langevin has clearly indicated that FIG. 1 illustrates a "known rotator" and refers in paragraph 10 to U.S. Patent 5,168,492. The known rotator employs ONE clockwise rotator and ONE counterclockwise rotator. There is no suggestion in Langevin that slices of the clockwise rotator or slices of the counterclockwise rotator have different reference phases.

Therefore, Langevin does not show a plurality of clockwise rotators and a plurality of counterclockwise rotators as required by claim 17, but instead merely shows a single rotator which single rotator can be sliced into parallel rotator slices. For this reason as well it is readily apparent that Langevin could not show the claim 17 feature of different clockwise rotators having different reference phases and different counterclockwise rotators having different reference phases.

It is apparent from FIG. 2 of Langevin that Langevin's rotator switch comprises two rotators: 18 and 28 (which Langevin alternately refers to as commutators -- see paragraph 46 -- and space switches -- see paragraph 49) and that rotators 18 and 28 operate in different directions. Langevin does not show the claim 17 feature of different clockwise rotators having different reference phases and different counterclockwise rotators having different reference phases.

Therefore, it is submitted that Beshai and Langevin fail to teach or suggest all the claim limitations of claim 17 and that, therefore, the Examiner has failed to make out a *prima facie* showing of obviousness.

**Claim 18**

The Examiner contends that FIG. 2 of Langevin discloses the claim 18 features of "each of said clockwise rotators … operable to connect each of said switch modules to each other of said switch modules during a rotation cycle, where said rotation cycle includes a plurality of rotation phases, and each of said counterclockwise rotators is operable to connect each of said switch

modules to each other of said switch modules during said rotation cycle".

Applicant traverses this suggestion.

Referencing FIG. 2 of Langevin, it is apparent that a clockwise rotator 18 is interposed between source nodes 10-16 to tandem nodes 20-26 and that a counterclockwise rotator 28 is interposed between tandem nodes 20-26 and destination nodes 30-36. Therefore, Langevin's clockwise rotator 18 is operable to connect the source nodes with the tandem nodes while counterclockwise rotator 28 is operable to connect the tandem nodes with the destination nodes. In contrast, claim 18 requires that each clockwise rotator of a plurality of clockwise rotators and each counterclockwise rotator of a plurality of counterclockwise rotators connect the same set of switch modules.

Consequently, Applicant asserts that Langevin does not in fact disclose the features recited in claim 18. Further, Applicant notes that Beshai has the same failing as Langevin as, referencing FIG. 2 of Beshai, it is seen that Beshai's clockwise rotators 30 are interposed between ingress switching modules 22 and a bank of independent memories 28 whereas the counterclockwise rotators 32 are interposed between the bank of independent memories 28 and egress switching modules 24.

Therefore, it is submitted that Beshai and Langevin fail to teach or suggest all the claim limitations of claim 18 and that, therefore, the Examiner has failed to make out a *prima facie* showing of obviousness.

**Claim 19**

The Examiner asserts that Beshai shows the added features of claim 19 of "a plurality of module controllers, each module controller of said plurality of module controllers associated with a switch module of said plurality of switch modules; and a master controller operable to: determine

a schedule for data exchange among the switch modules".

Applicant respectfully submits that Beshai provides a distributed switch comprising a plurality of core modules **34** and a plurality of core controllers operating concurrently and independently, one core controller for each of the core modules **34** (FIG. 3 in Beshai). The switch employs distributed control and there is no master controller for the entire switch.

The distributed control in Beshai is described in several places in the Beshai reference. Some reference excerpts are recited below (emphasis added):

In the abstract:

A self-configuring distributed packet switch .... The switch comprises a <u>distributed channel switching core</u>, the core modules being respectively connected by a plurality of channels to a plurality of high-capacity packet switch edge modules. Each core module operates <u>independently</u> to schedule paths between edge modules, and reconfigures the paths in response to dynamic changes in data traffic loads reported by the edge modules."

At Column 2:40-44:

"A concentration of switching capacity in one location is, however, undesirable for reasons of security and economics. Consequently, it is desirable to provide a high-capacity switch with <u>a distributed core</u>."

Column 2:49-52:

"There therefore exists a need for a very high-capacity packet switch with a <u>distributed core</u> that is adapted to provide grade of service and quality of service guarantees."

Column 3:59-64:

"... there is provided a <u>distributed packet switch</u>. The distributed packet switch comprises a plurality of m cross connectors, a plurality of n core modules, a plurality of m×n edge modules,

and a plurality of n core controllers each having a core scheduler."

Column 4:3-6:

"The edge modules and the core modules can be spatially distributed over a wide geographical area and the outer and inner links are preferably wavelength-division-multiplexed links."

Column 7:13-14:

".... core modules 34 are geographically distributed."

Column 11:32-34:

"FIG. 7 illustrates a scheduling function performed by each of the controllers for the respective core modules 34."

Therefore, it is submitted that Beshai and Langevin fail to teach or suggest all the claim limitations of claim 19 and that, therefore, the Examiner has failed to make out a *prima facie* showing of obviousness.

**Claim 20**

The Examiner asserts that Beshai shows the added features of claim 20 of "the master controller is further operable to receive a connection request and select one of said clockwise rotators and one of said counterclockwise rotators for routing the requested connection". The Examiner references column 5:15-25 in Beshai which describes a core controller of one of the core modules 34.

Applicant submits that the distributed switch of Beshai (FIG. 3) does not employ a master controller. Instead, each ingress edge module 22 selects one of the core modules 34, hence – if a core module 26 has the structure illustrated in FIG. 2, then an ingress edge module 22, in effect, selects one of the clockwise rotators 30. The selected core module 34 has a core controller which

has no role in selecting the clockwise rotator 30.

Edge control is described throughout the Beshai reference. See for example (emphasis added):

Column 4:52-55:

"the ingress module selecting the egress modules to which to send the packets, sending connection requests to <u>selected core modules</u>, and requesting connections of specified capacities."

In claim 1(column 13):

"wherein said ingress controller is operable to

> ......
>
> send a capacity-request vector <u>to a selected one of the core controllers</u>, the capacity-request vector including capacity-allocation requests for connections to a subset of the egress modules."

In claim 50 (column 18):

"A method of switching a packet .... comprising the steps of:

> one of said ingress modules receiving a packet from a subtending traffic source;
>
> said one of said ingress modules sending a connection request to a <u>selected one of the core modules</u>, requesting a connection of a specified capacity to one of said egress modules;
>
> <u>said selected one of the core modules</u>:
>
> > determining available capacity;
> >
> > ......

Claims 51 to 53 recite different ways of selecting a core module.

The core scheduler 52 in Langevin (FIG. 4) connects to source nodes and the source nodes connect to one clockwise rotator as illustrated in FIG. 4. Therefore, the claim 20 feature of selecting one of multiple clockwise rotators is not shown in Langevin.

Therefore, it is submitted that Beshai and Langevin fail to teach or suggest all the claim limitations of claim 20 and that, therefore, the Examiner has failed to make out a *prima facie* showing of obviousness.

**Claim 21**

The Examiner asserts that Beshai discloses the added feature of claim 21 of "the master controller … operable to determine a switching delay from each of said switch modules to each other of said switch modules through each of said clockwise rotators and through each of said counterclockwise rotators. The Examiner refers to column 8:1-36 in Beshai.

Applicant submits that column 8:1-36 describes a method for accounting for <u>propagation delay</u> between ingress edge modules 22 and individual core modules 34 in a distributed switch 20 where the core modules 34 are geographically distributed over a wide area. Claim 21 relates to <u>switching delay</u> within switch modules, which is clearly different from propagation delay. Therefore, the Beshai reference does not disclose the added limitations of claim 21. It is also submitted that the limitation of claim 21 is also not shown by Langevin.

Therefore, it is submitted that Beshai and Langevin fail to teach or suggest all the claim limitations of claim 21 and that, therefore, the Examiner has failed to make out a *prima facie* showing of obviousness.

**Claim 22**

Claim 22 is rejected as being unpatentable over Beshai in view of Langevin.

Claim 22 recites a programmable clockwise rotator. Applicant submits that neither Beshai nor Langevin mentioned a programmable rotator.

Furthermore, the claim language implies presence of more than one clockwise rotator: "wherein at least one of said <u>clockwise rotators</u> is programmable to set its reference phase." However, there is only <u>one clockwise rotator</u> (reference numeral 18, FIG. 1) in the switch of Langevin. The single clockwise rotator of Langevin is sliced into <u>rotator slices</u> as illustrated in FIG. 10 and FIG. 11 in Langevin. The rotator slices rotate in unison.

Clearly, neither the Beshai reference nor the Langevin reference, taken individually or in combination, teaches the limitation of claim 22.

**Claim 23**

Claim 23 is rejected as being unpatentable over Beshai in view of Langevin.

Claim 23 recites spreading reference phases of clockwise rotators. Applicant submits that Beshai does not mention spreading the reference phases of the rotators of the distributed core modules. Claim 23 recites "wherein the reference phases of said plurality of clockwise rotators <u>are evenly spread over said rotation cycle</u>." The limitation of claim 23 is applicable to multiple clockwise rotators and is not applicable to a single clockwise rotator. Langevin employs one clockwise rotator 18 which may be sliced into rotator slices rotating in unison.

Clearly, neither the Beshai reference nor the Langevin reference, taken individually or in combination, teaches the limitation of claim 23.

**Claim 24**

Claim 24 is rejected as being unpatentable over Beshai in view of Langevin.

Claim 24 recites a programmable counterclockwise rotator. As described above, with reference to claim 22, neither Beshai nor Langevin mentioned a programmable rotator.

Also, the claim language implies presence of more than one counterclockwise rotator: "wherein at least one of said counterclockwise rotators is programmable to set its reference phase." However, there is only one counterclockwise device (reference numeral 28, FIG. 1) in the switch of Langevin. The single counterclockwise device of Langevin is sliced into rotator slices as illustrated in FIG. 10 and FIG. 11 in Langevin. The rotator slices rotate in unison.

Clearly, neither the Beshai reference nor the Langevin reference, taken individually or in combination, teaches the limitation of claim 24.

**Claim 25**

Claim 25 is rejected as being unpatentable over Beshai in view of Langevin.

Claim 25 recites spreading reference phases of counterclockwise rotators. As described above with reference to claim 23, Beshai does not mention spreading the reference phases of the rotators of the distributed core modules. Claim 23 recites "wherein the reference phases of said plurality of counterclockwise rotators are evenly spread over said rotation cycle." The limitation of claim 25 is applicable to multiple counterclockwise rotators and is not applicable to a single counterclockwise rotator. Langevin employs one counterclockwise device 28 which may be sliced into rotator slices rotating in unison (i.e., having the same reference phase).

Clearly, neither the Beshai reference nor the Langevin reference, taken individually or in combination, teaches the limitation of claim 25.

In view of the foregoing, early favourable reconsideration of this application is respectfully requested.

Respectfully submitted,

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May 29/09
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**Claims Appendix**

(Claims on Appeal)

17. A polyphase circulating switch comprising:

a plurality of switch modules;

a first plurality of clockwise rotators each of said clockwise rotators having a respective reference phase; and

a second plurality of counterclockwise rotators each of said counterclockwise rotators having a respective reference phase;

wherein each of said switch modules is communicatively connected through a dual channel to each clockwise rotator and to each counterclockwise rotator and wherein at least two of said clockwise rotators have different reference phases and at least two of said counterclockwise rotators have different reference phases.

18. The polyphase circulating switch of claim 17 wherein each of said clockwise rotators is operable to connect each of said switch modules to each other of said switch modules during a rotation cycle, where said rotation cycle includes a plurality of rotation phases, and each of said counterclockwise rotators is operable to connect each of said switch modules to each other of said switch modules during said rotation cycle.

19. The polyphase circulating switch of claim 17 further comprising:

a plurality of module controllers, each module controller of said plurality of module controllers associated with a switch module of said plurality of switch modules; and

a master controller operable to:

determine a schedule for data exchange among the switch modules; and

transmit said schedule to said each module controller.

20. The polyphase circulating switch of claim 19 wherein the master controller is further operable to receive a connection request and select one of said clockwise rotators and one of said counterclockwise rotators for routing the requested connection.

21. The polyphase circulating switch of claim 19 wherein the master controller is further operable to determine a switching delay from each of said switch modules to each other of said switch modules through each of said clockwise rotators and through each of said counterclockwise rotators.

22. The polyphase circulating switch of claim 17 wherein at least one of said clockwise rotators is programmable to set its reference phase.

23. The polyphase circulating switch of claim 22 wherein the reference phases of said plurality of clockwise rotators are evenly spread over said rotation cycle.

24. The polyphase circulating switch of claim 17 wherein at least one of said counterclockwise rotators is programmable to set its reference phase.

25. The polyphase circulating switch of claim 24 wherein the reference phases of said plurality of counterclockwise rotators are evenly spread over said rotation cycle.

## Evidence Appendix

None.

## Related Proceedings Appendix

None.